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SCIENCE

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FRIDAY, OCTOBER 16, 1896.

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THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS—ADDRESS BY THE PRESIDENT— THE EVOLUTION OF ECONOMIC ENTOMOLOGY.

THE earliest accounts of injuries caused by insects, so far as I have seen, are contained in the Old Testament, but nowhere in this work is it stated that attempts of any kind were made to destroy the insects or hold them in check in any way. In many instances the visitations of insects in large numbers were looked upon as plagues sent by the Almighty. Three of the plagues of Egypt, portrayed so vividly in the book of Exodus, were caused by insects, one by lice, one by flies and one by locusts, but in each case Pharaoh looked for and sought relief only by divine interposition through the good influence of Moses, 'the great lawgiver.'

In the book of Joel sundry judgments of God are declared, among which the devastations of insects are referred to with some detail. The prophet seems to take a pessimistic view of their work, and no hint is given, or even suggested, of any method of checking their ravages.

Aristotle, in his History of Animals, published about 200 years before the Christian era, while treating of insects, gives us nothing whatever of an economic nature concerning them.

Pliny, in his great work on the History of the World, published about the year 77

of the Christian era, has given much of interest concerning the work of insects and the methods of destroying them adopted in those times. In the eleventh book of this work, p. 327, it is stated that if the spring be wet and rainy the eggs of the locust, which have remained in the ground during the winter, perish and do not hatch. Pliny further says that whole armies of locusts often came from Africa into Italy, and many a time the people of Rome, fearing a famine, had recourse to the Sibylline books for a remedy and to avert the wrath of the gods. These books were supposed to contain the fate of the Roman Empire. In the Cyrenian province of Barbary it was ordered by law that all the inhabitants should wage war against the locusts, first by hunting for their eggs and crushing them, second by killing the young, and lastly by destroying the adults. A severe punishment was inflicted on those who neglected to perform this duty. On the island of Stälimni it was determined just what quantity each man should kill, and the full measure was required to be exhibited to the magistrate. The people made much account of the assistance rendered by the jays and other birds in destroying the locusts. This account given by Pliny is the earliest concerning the enactment of laws for the destruction of insects that I have anywhere found.

This is more in accordance with our modern ideas on economic entomology than the remedy given by Cato for caterpillars on fruit trees, which was to moisten the tips of the twigs with the gall of a green lizard, or the remedy for canker worms given by Pliny, which was to hang the bones of a mare's head on the pales around the garden. He emphasizes the fact that the bones must be those of a female, as those of the male would prove of no avail. It appears that the common people needed special cautioning in these matters in the days of Pliny just as they do to-day.

In the twenty-fifth book, chapter five, Pliny says that if white hellebore be powdered and put into milk all the flies that eat of it will be destroyed. This is the earliest mention I have found of the use of white hellebore as an insecticide. I do not know who claims the honor of the discovery of hellebore as an insecticide in modern times.

The next account in order of time that I have been able to find is given by Berg in his *History of the German Forests*. In the year 875 hosts of grasshoppers appeared on the Rhine and destroyed all the grass and grain. The remedies employed for their destruction were by the priests, who went in procession around the infested fields, carrying holy relics and making intercessory prayers, 'but,' adds the chronicler, 'it was of no avail.' This was said to be the oldest record to be found of methods of treating insects in German lands, and was taken from the Bavarian chronicle of Aventinus.

During the Middle Ages lamentations over the destructive ravages of different species of insects are of frequent occurrence in many chronicles of those times. The means used for the destruction of insects were all, so far as we can learn, of a spiritual nature. In the fourteenth century Uhland, in his contributions to the history of poetry and legend, relates that the Bishops of Chur and Lausanne pronounced the anathema over grasshoppers and other insects. At one time a thorough-going procedure, according to all the rules of jurisprudence, occurred before the spiritual judge. The accused insects were summoned, and in case of non-appearance, which always occurred unless the insects were moving to new feeding grounds and the court house happened to be in their way, a proxy was appointed to represent the accused insects, who debated the whole subject with the accuser, after which judgment was rendered, invariably against the

accused insects, in the form of an excommunication which was carried into effect only when the insects disappeared at the time of pupation.

Lesser, in his 'Insecto-Theology,' published in London in 1799, says: "We are at this day still almost in the dark with regard to those means by which we may deliver ourselves from the depredations of insects. In the Church of Rome recourse has been had to different exorcisms. Other people have fabricated amulets and talismans, to which great virtues have been attributed.

"Whatever credit these means have gained with the people, they are far from having the efficacy of prayer, or the worth of the remedies I am about to prescribe.

* * * * *

"There are several ways of preventing the increase of insects, the easiest and most natural, in my opinion, are the following: By spreading on the ground ashes mixed with pigeon's or goat's dung, not only insects newly come forth, but those about to be hatched are destroyed. By destroying the old ones we rid ourselves of the generation they would have produced, and we thus perform in an instant what we would not fail to have been employed in during the whole course of a year. But should the season anticipate our intentions we must seek their nests in the furrows and clefts of trees. In truth the industry of insects in choosing places in which their brood may be in safety makes it impossible, but some of them will escape our search; but if in one province the country people would use stratagems on their part it is certain that they would insure that profit of which they are often frustrated.

"We cannot defend fruit trees from the ravages of caterpillars better than by carefully pruning them. By this they acquire much more sap; and, as these insects are not fond of too abundant juice, they seek

elsewhere a food more to their taste. If the approach of winter obliges them to gather together in the nests which they form at the extremities of the branches they must be taken off before the spring has made any progress.

"It is possible that these means may not be practicable at all times; but then other stratagems must be fallen upon to stifle the evil in its birth. If caterpillars, ants and other insects roam over the ground, and have not yet got upon the trees they are in search of, a stratum of ashes or of chalk must be laid at the bottom, which will obstruct their passage. I believe this to be infallible; for, besides that they are enemies to all constraint, they would be so embarrassed by these substances that they would not be able to disengage themselves. Twisted straw, clay, wool and cotton are likewise successful obstacles to their ascent. Circles of them are put around the stem of the tree, and, if a little resinous substance is added to them, the tree will be out of danger. Let us change the case: suppose the insects have already gotten upon the trees, plants and bushes, the hand must be employed. But there are some times when this is done with greater success than at others, as in the morning, the evening and during rain. These times are preferable to any part of the day, because coolness and humidity cause insects to collect together, and then they form heaps which may be crushed at once. If, moreover, they have gained the top, and the height prevents their being reached with the hand, the tree must be shaken, or a pole, with rags on the end of it, employed to sweep them off. But expedients must be suggested by circumstances. Another snare, the success of which is not less happy, for securing fruit trees is to lay the trunk over with glue, etc."

This represents fairly well the status of economic entomology at the end of the

last century. It is undoubtedly true that the great advances made in the systematic study of insects during the last half of the 18th century, by Linnæus, Fabricius, Denis and Schiffermiller, Esper, Herbst, Schrank, Illiger, Scopoli, Latreille, Rosel, Panzer, Olivier and a host of others, gave a great impetus to economic entomology, as shown by the remarkable work of Bechstein on 'Forest Insects,' published in 1804-5; 'Hints to the Proprietors of Orchards,' by Salisbury, published in London in 1816; Kollar's 'Insects Injurious to Farmers and Gardeners,' published in 1836; Ratzeburg's 'Forest Insects,' published in 1840, with many others in Europe; while in this country there were numerous essays on injurious insects and methods of destroying or holding them in check, published in the early part of this century. Harris published numerous papers on economic entomology in the *New England Farmer*, beginning as early as 1823, but his classic work on the 'Insects of Massachusetts Injurious to Vegetation' appeared near the end of 1841. Fitch published his first 'Report on the Insects of New York' in 1855, and this was followed by thirteen others. Townend Glover began his work in economic entomology in 1854, from the smallest beginnings, and we can scarcely realize that in forty years the division of entomology, under the leadership of such brilliant men as Riley, Comstock and Howard, with their able assistants, should now be giving to the world such masterly reports as emanate from that center.

It is not my intention, however, to speak so much of the men as of the development of methods in economic entomology. The entomologists of the present century have given us rational methods for combating insects; methods based on a more or less complete knowledge of the entire life history of the different species of which they treated, with their natural enemies and the best artificial means for their destruction

that their ingenuities could devise. It was sometime in the sixth decade of this century that arsenical compounds were proposed. There was bitter opposition to the use of these insecticides for a long time, and the reports of cases of poisoning, which were said to have occurred at that time, were startling in the extreme. It was even claimed that potatoes would absorb the poison to such an extent that the tubers would carry poisonous doses, so that after each meal it would be necessary to take an antidote to the poison. There is something in the human mind that leads it to accept the dreadful more readily than the prosaic, and as many believed the fabulous stories so widely circulated at that time, and for a long time after the advent of the beetle into the extreme east of this country, it was a common thing to see large fields of potatoes with persons of all ages and both sexes, each carrying a pan and stick with which they knocked the potato beetles off into the pan. Little by little, however, one farmer after another abandoned the 'stick and pan' method and adopted the use of Paris green, till it came into very general use. This seemed to give it popularity and there developed a readiness to use any kind of substance that bore the name of insect poison, till now the market is well stocked with a great variety of substances which are claimed to kill all kinds of insects. London purple followed closely in the wake of Paris green, and kerosene emulsion has also come into great favor for the destruction of the sucking insects, or such as do not eat the entire substance of the leaf. Thus we have several excellent insecticides which are in such general use that we may call the latter half of this century the period of insecticides.

There were men in the past ages who were far ahead of their times in economic entomology as well as in other departments of human knowledge. J. C. Schaeffer, in

the third part of his work on the gypsy moth, published in 1761, discusses the methods of destroying this insect in a manner equal to Harris or Fitch, while Pastor Rimrod, in his paper published in 1781, on the same insect, handles the subject with equal ability. These papers were rare exceptions in those times, and probably made little impression on the public mind because they were so much in advance of the times. On the other hand, there are men to be found in all ages who are very much behind the times, and we may even now find men who believe every invasion of insects to be an Israelitish plague sent upon us because of the sins of the people.

In 1875 Governor Harding, of Missouri, issued a proclamation appointing a day of fasting and prayer for the interposition of Divine Providence to relieve the calamities caused by the devastation of the Rocky Mountain Locust. Many of us well remember the newspaper accounts of the terrible suffering and starvation in some of the Western States caused by this insect in those times, and it need not surprise us so very much if, after having tried every plan that human ingenuity could devise, they should, in their final extremity, have appealed to Almighty God. This is about the way with us all. In the supreme hour, when everything else fails, we remember and appeal to the Overruling Providence. If I may be permitted here to express a personal opinion along these lines I would say that, while it is exceedingly helpful to the human soul to trust in the Divine Creator of heaven and earth, I cannot rid myself of the conviction that in economic entomology God helps those most who most help themselves; those who make themselves most conversant with his laws as exhibited in the life and habits of the insects they have to deal with, as well as the climatic and other conditions which affect them—in fact the whole environment—and make the best

possible use of this knowledge in their attempts to destroy insects or hold them in check.

Last year the Chairman of the Board of Selectmen in a Massachusetts town refused to use any of the public money for the protection of the trees along the streets, from the canker worms, because the idea of fighting insects was 'agin natur.' This year that same man's apple trees are as bare of leaves as though a fire had run through his orchard, and therefore I am of the opinion that it will be 'agin natur' for that man to gather a crop of fruit from his trees this fall.

The establishment of agricultural experiment stations by the general government in 1888, with entomologists in a large proportion of them, gave a wonderful impetus to the study and development of economic entomology in this country. At first it was thought that, because of the lack of a sufficient number of well trained and experienced entomologists to fill these positions, very poor work would be done until a sufficient time had elapsed for young men to become educated and trained in this line, when they would crowd the more inferior material to the wall. To me it has been a matter of pleasure and pride to see the young men coming to the front so rapidly, filling these places so satisfactorily and publishing bulletins and other papers of such rare value. I am deeply impressed with the idea that, unless those of us who are older and have been in the work for a long time look well to our laurels, we may soon find ourselves crowded up against the displacement wall and younger, perhaps more competent, men standing ready to take our places. Nevertheless it is a great pleasure to me to help and encourage any promising and modest young man who is thoroughly in earnest in the study of entomology.

In this connection I cannot too highly

commend the course taken by some of our economic entomologists who, in connection with their other work, make a systematic study of some family or group of insects, or study thoroughly the anatomy or embryology of one or more species. Even a fragment of such study will sometime prove useful, since it forms a link in the great chain of human knowledge and each link forged into it tends to strengthen and make it more useful. I have no sympathy with those who work only in one restricted field till they become so narrow that they can appreciate nothing except what is to be found in their own extremely narrow groove. The entomologist who broadens the horizon of his observations becomes better able to grasp and comprehend the great problems presented to him.

With the discovery of insecticides came the necessity for various kinds of apparatus for the application of them, and here again there has been an evolution which is still going on. Many of the spraying pumps, nozzles and other apparatus first placed on sale are no longer in use, but greatly improved kinds are on the market, and investigations are still giving us improvement after improvement, some of which, unfortunately, are no improvement at all. On the whole, however, the insecticide apparatus of to-day is greatly superior to that of a decade ago.

THE FUTURE OF ECONOMIC ENTOMOLOGY.

It seems to me that in the future development of economic entomology we have need of the chemist and of the physiologist. Some work has already been done on the use of Paris green and lime, but the results do not appear to be beyond question. It is to be hoped that the investigations already made in the work on the gypsy moth, as well as those not yet completed, may prove of value in operating on other species of insects. This work has already

given us arsenate of lead and arsenate of barium as insecticides, and investigations are still going on concerning the nature of the intestinal secretions of this insect and the poisons that will most readily react on these secretions and thereby destroy it. It may be that investigations by the chemist and physiologist, working together along these lines, may give us something in the future superior to anything in use at the present time. The three most important characteristics of an insecticide, which must be kept constantly in mind, when investigating a new or untried poison, are: 1st. It must kill the insects quickly, the more quickly the better. 2d. It must not injure the foliage when used in as large proportion as one may need for the destruction of the insects. 3d. It must be cheap enough to come into general use. There are other considerations of more or less importance, as the ease with which the insecticide may be applied, its liability to clog the nozzles or corrode and injure the apparatus, and, in fact, any objection that will prevent the substance from coming into general use.

After one has made valuable investigations and discoveries in economic entomology, it remains for him to publish his discoveries in such a place as will be accessible to those who most need this information, and in such a manner as to lead them to read the paper carefully and intelligently. I know very well that there are thousands of persons who receive our bulletins who do not even look them over. I was told by the editor of one of our leading agricultural papers, a few years ago, that he sent out a circular letter to his subscribers, asking what changes, if any, they would like to have him make in his paper, and a large percentage of them requested him to give them more stories; and I have sometimes wondered if the information given in our bulletins were presented in the form of a

strongly sensational novelette they would not get a much more general reading. Personally I cannot adopt the plan, as I have no skill as a novelist.

After all, it is more important to investigate and make new and valuable discoveries, even if they are not so widely read at first, for they will be taken up by others and disseminated far and wide, and in time the useful information will become filtered through the public mind.

There is often need of legislation to aid in the carrying out of the recommendations of the economic entomologists, and this is an important question at the present time. There is no law in Massachusetts to prevent a nurseryman or any one else from selling and distributing nursery stock that is infested with the San José scale, or of distributing and establishing colonies of injurious insects, except the gypsy moth, nor is there, so far as I know, any law in the land to prevent the importation of injurious insects from any other country.

I have generally felt very shy of legal enactments, because they are so often couched in language quite beyond my comprehension, and in many cases they seem to require a 'Philadelphia lawyer' to interpret them, and even then two lawyers frequently differ in their interpretation of the same legal point. I am, therefore, of the opinion that there is need of great clearness and simplicity in the wording of an act, and also that it would be wise to have more or less uniform laws in all the States concerning those injurious insects which are, or are liable to be, generally distributed throughout the country. In this matter we should also consider our nearest neighbors, Canada and Mexico, for, while politically distinct from us, entomologically there is no dividing line.

In conclusion, allow me to congratulate you on the growth, importance and success of the Association, and bid each and every member Godspeed in his chosen field of

labor, assuring him that every good piece of work he may perform will not only redound to his credit, but will add to the sum-total of human knowledge and human happiness.

C. H. FERNALD.

*EIGHTH ANNUAL MEETING, BUFFALO, N. Y.,
AUGUST 21-22, 1896.*

THE Association was convened in the lecture hall of the Library Building, Buffalo, N. Y., and its meetings were attended by some 19 active members, including the following officers: President, C. H. Fernald; Vice-President, F. M. Webster, and Secretary, C. L. Marlatt. A number of entomologists not members of the Association were also present, with other zoologists, the number of persons present at the meetings averaging about 30.

The following new active members were elected:

W. G. Johnson, College Station, Md.
E. E. Bogue, Stillwater, Okla. Ter.
James S. Hine, Wooster, Ohio.
C. W. Mally, Wooster, Ohio.
H. L. Frost, Boston, Mass.
M. F. Adams, Buffalo, N. Y.
Lewis Collins, Brooklyn, N. Y.
W. E. Rumsey, Morgantown, W. Va.

The following new foreign members were elected:

Chas. P. Lounsbury, Department of Agriculture, Cape Town, Cape of Good Hope.
Fred. Enock, 21 Manor Gardens, Holloway, London, England.
Dr. Enzo Reuter, Fredriksgatan 45, Helsingfors, Finland, Russia.
Frederick B. Theobald, Wyecourt, Kent County, England.
Dr. Antonio Berlese, R. Scuola Superiore de Agricoltura, Portici, Italy.
Dr. Paul Marchal, 16 Rue Claude Bernard, Paris, France.
W. C. Grasby, Parkside, Adelaide, South Australia.

The active membership of the Association now numbers 86, and includes practically all of the leading workers in economic entomology in the United States and Canada. The foreign membership numbers